§9. Profile Measurements in Magnetic Field Scanning Experiments

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The dependence of global confinement of NBI plasmas on the magnetic field strength was reported in the last Annual Report 1992-1993. It showed the increase in confinement time with the magnetic field strength similar to the LHD scaling ($\tau_E \propto B_t^{0.86}$). To understand the confinement in more detail, it is necessary to proceed to the discussions with the profiles of density and temperature as well as the evaluation of the power deposition profile.

Profile measurements were made for both electrons and ions of NBI plasmas for five different magnetic field strength (B_t = 0.6, 0.9, 1.2, 1.5, 1.8 T). The magnetic field configuration with R_{ax} = 92.1 cm was used. NBI-1 was used in co-injection for the heating with about 700 kW injection power and 36-37 keV beam energy. The profiles were taken at the time when the plasmas became almost stationary with the average density 3×10^{13}cm^{-3}. Figure 1 shows electron temperature profiles taken with the single point Thomson scattering diagnostics for five different magnetic field strength. The density profiles were almost flat within the radius r/a < 0.6 except that the B_t = 1.2 T plasma had a little hollow profile, which was caused by the small difference of gas puffing operation. The electron temperature increased continuously with the magnetic field strength in the central region while it gave much smaller increase for B_t > 1.2 T in the boundary region. From the shape of profiles, it is clearly observed that the magnetic axis shift is larger for weaker magnetic field strength.

Figure 2 shows the ion temperature profiles taken with the TVCXS diagnostics at the same time as the electron measurements. The increase in the temperature by increasing the magnetic field is observed which is similar to the electron measurement. But it is also observed that the rate of increase is smaller than the electron case especially in the central region. Because the geometrical structures of high energy beam orbits are very different for such wide range of B_t variation, the calculation of power deposition profiles based on the computer simulation is necessary for the detailed transport analysis.

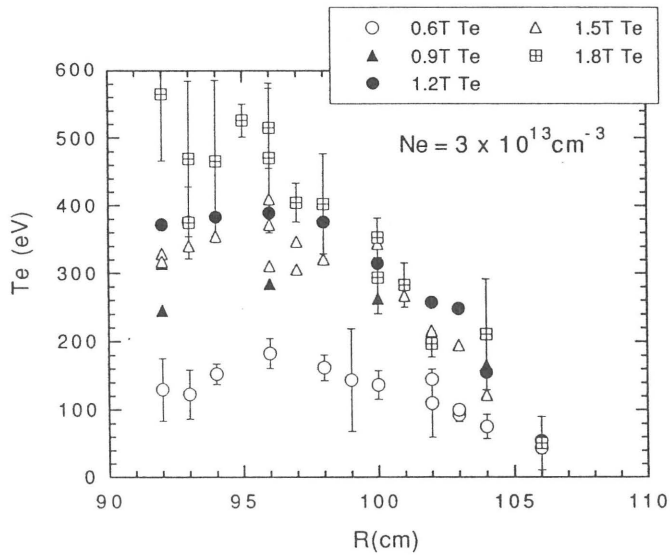

Fig. 1 Electron temperature profiles taken with Thomson scattering for five different magnetic field strength.

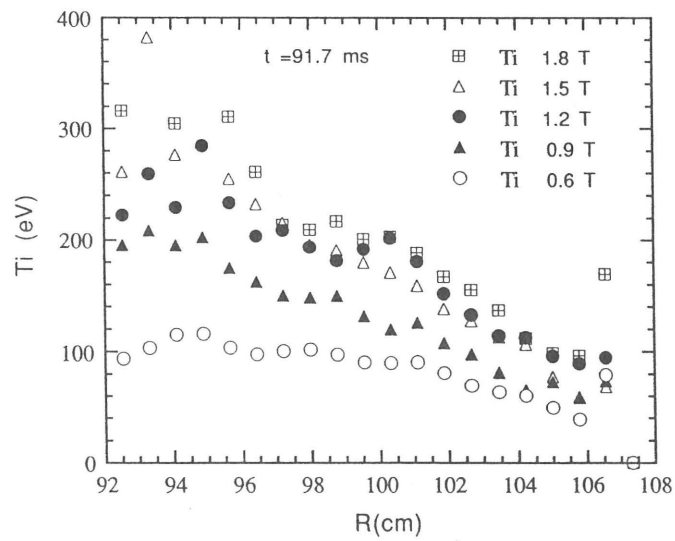

Fig. 2 Ion temperature profiles taken with TVCXS for five different magnetic field strength.